

1. Overview

This Manual explains the requirements for approval of residential *Alternative Calculation Methods* (ACMs). Residential ACMs are used to demonstrate compliance with the performance approach to the California Energy Efficiency Standards for Low-Rise Residential Buildings as defined in the building energy efficiency standards of the State Building Code.

The approval procedure is one of self-testing and self-certification by the ACM vendor of an ACM. The vendor conducts the specified tests, evaluates the results and certifies in writing that the ACM passes the tests. The California Energy Commission (Commission) will perform spot checks and may require additional tests to verify that the proposed ACM is suitable for compliance purposes. The vendor is required to develop a compliance supplement (program user manual) explaining how to use the program for showing compliance with the standards. The compliance supplement will also be checked by the Commission for accuracy and ease of use.

When energy analysis techniques are compared, there may be two basic sources of discrepancies: differences in user interpretation when entering the building specifications, and differences in the ACM's algorithms for estimating energy use. The approval tests in this manual are designed to minimize differences in interpretation by providing explicit detailed descriptions of the test buildings that must be analyzed.

This Manual is written as if all ACMs are computer programs. While this is generally true, there is nothing to prohibit other kinds of energy analysis methods from seeking ACM approval. The basic requirements for accuracy and reliability still apply.

1.1 Summary of ACM Changes

The ACM Approval Manual is updated with each major revision of the low-rise residential Standards. This manual is to be used with the 2001 Standards. The major changes between this manual and the 1998 manual are summarized below.

1.1.1 Modeling Assumptions

Several changes have been made to the way energy use is calculated in the public domain program, as summarized below.

- Interior Shading
- Space Conditioning System Efficiency (including a variety of assumptions such as air flow, refrigerant charge, fan wattage and efficiency adjusted for California's outdoor operating temperatures)

1.1.2 Standard Design Definition

The definition of the standard design (the custom budget building) has been updated to correspond with the performance levels required by the 2001 Standards.

1.2 ACM Requirements

This chapter presents the general requirements for residential ACMs. Appropriate inputs for all modeling capabilities are discussed in Chapter 2. Chapter 3 has the rules for defining the *Standard Design*. Chapter 4 has algorithms and modeling assumptions used in the reference method. Chapters 5 and 6 have accuracy tests. Chapter 7 has requirements for field verification and diagnostic testing. Chapters 8 and 9 have requirements for ACM vendors.

1.2.11.1 Minimum Modeling Capabilities

Minimum modeling capabilities ~~must~~shall be included in all ACMs. If a candidate ACM does not have all of these capabilities, then it cannot be approved for compliance. The minimum modeling capabilities are summarized below:

- Conduction gains and losses through opaque and fenestration surfaces.
- Infiltration gains and losses
- Solar gains through glazing including the effects of internal shading devices, external shading devices and fixed overhangs.
- Natural ventilation cooling and natural ventilation for Indoor Air Quality (IAQ).
- Mechanical Ventilation for IAQ.
- Thermal mass effects to dampen temperature swings.
- Space conditioning equipment efficiency and distribution systems.
- Water heating equipment efficiency and distribution systems.
- Radiant Barriers
- Cool Roofs
- Maximum Cooling Capacity

1.2.21.2 Optional Modeling Capabilities

Candidate ACMs may have more capabilities than the minimum required. ACMs can be approved for use with none, a few, or all of the optional capabilities. The following optional capabilities are recognized for residential ACMs:

- Raised floors with automatically operated crawl space vents.
- Zonal control or multi-zone modeling of the sleeping and living areas of the house.
- Attached sunspaces for collection and possible storage of heat for transfer to the main house.
- Exterior mass walls.
- Side Fin Shading.
- Combined hydronic space and water heating.
- Building additions.
- Solar water heating.
- Form 3 report generator.
- ~~Gas-Fired Heat Pumps~~ Absorption Cooling

Many of the optional modeling capabilities have been previously approved by the Commission through the exceptional methods process. The approval tests for optional modeling capabilities are included in Chapter 6. ~~To determine how to apply for the Exceptional Method Application (EMA) to provide optional modeling capability, refer to Section 1.8, Page 1-6 of this Manual.~~

1.3 Application Checklist

The following is a checklist of all the items that ~~must~~shall be included in an application package for ACMs. Some materials are required only for general purpose ACMs and are so indicated.

- *ACM Vendor Certification Statement.* A statement from the ACM vendor certifying the ACM, and, its reliability and accuracy when used for compliance purposes (see ~~Appendix ACM RA-2005, Page A-1~~).
- *Computer Run Summary Sheets.* Hard copy summary sheets of all the required computer runs (see ~~Appendix ACM RA-2005, Pages A-2 to A-12~~).
- *Computer Runs.* Copies of the computer runs specified in Chapters 5 and 6 of this Manual, including complete input and output files, on diskettes or in ~~IBM-compatible~~ computer readable form acceptable to the Commission to enable spot checks.
- *Compliance Supplement.* A copy of the Compliance Supplement discussed in Chapter 8. The Compliance Supplement and the ACM User's Manual may be combined into the same document.
- *Copy of the ACM.* A magnetic media copy of the ACM (in ~~IBM PC-compatible, or other a~~ format agreed to by the Commission staff) for verification of analyses and random verification of compliance analyses. Weather data ~~must~~shall be included.
- ~~Weather Data Documentation. For those general purpose ACMs not using the standard Commission, full year, hourly weather data, a copy of the summarized weather data must~~shall be submitted. Documentation ~~must~~shall be included on the method used to develop the summary weather data.
- *Application Fee.* An application fee of \$1,000.00 (one thousand dollars) is required to cover costs of evaluating the application.

1.4 Types of Approval

This Manual addresses three types of ACM approval: full approval, streamlined approval of new program features, and amendments to full approvals.

1.4.1 Full Approval

Full approval is required when a candidate ACM has never been previously approved by the Commission, and/or when the ACM vendor makes changes to the executable program code or algorithms, or any other change that in any way affects the results. The Commission may also require that all ACMs be approved again when the standards are updated on the three-year cycle or whenever substantial revisions are made to the approval process, for instance, if new analysis capabilities come into widespread use, and the Commission declares them to be minimum capabilities for all ACMs.

When re-approval is necessary, the Commission will notify all ACM vendors of the timetable for renewal. There will also be a revised ACM Approval Manual published, with complete instructions for re-approval.

Full approval is required for all ACM changes, unless they qualify for the streamlined approval process or for an addendum, as discussed below.

1.4.2 Streamlined Approval

Certain types of changes may be made to approved residential ACMs through a streamlined procedure. Examples of changes that qualify for streamlined approval are modifications to the user interface or implementation on a different operating system as long as there are no changes to the executable program code that would in anyway affect the results.

If an ACM modification qualifies for streamlined approval, then the following procedure is followed:

- The ACM vendor prepares an addendum to the compliance supplement, when appropriate, describing the change to the ACM.
- The ACM vendor notifies the Commission by letter of the change. The letter ~~must~~shall describe in detail the nature of the change and why it is being made. The notification letter shall be included in the Compliance Supplement.

- Provide the Commission with an updated copy of the ACM and include any new reports created by the ACM (or modifications in the standard reports).
- The Commission responds in 45 days. The Commission response may take several forms. The Commission may request additional information, refuse to approve the change or require that the ACM vendor make specific changes to either the Compliance Supplement addendum or the ACM.
- With Commission approval, the vendor may issue new copies of the ACM with the Compliance Supplement addendum and notify ACM users and building officials.

1.4.3 Amendments

An ACM approval ~~must~~shall be amended when optional modeling capabilities are added. The vendor ~~must~~shall provide the additional computer runs required for the optional modeling capability. It is not necessary to include computer runs previously submitted.

An amendment to an approved ACM ~~must~~shall be accompanied by a cover letter explaining the type of amendment requested, and copies of other documents as necessary. All items on the application checklist should be submitted, when applicable. The timetable for approval of amendments is the same as for full approval.

1.4.4 When Approval Is Not Required

Changes that do not affect compliance with the Energy Efficiency Standards for Residential Buildings do not require full or streamlined approval. However, the ACM vendor ~~must~~shall notify the Commission and provide the Commission with an updated copy of the program and user manual. Re-approval is required for any ACM program change that affects the energy use calculations for compliance, the modeling capabilities for compliance, the format and/or content of compliance forms, or any other change which would affect a building's compliance with the Standards. Any questions regarding applicable approval procedures should be directed to the Commission.

1.5 Challenges

Building officials, program users, program vendors or other interested parties may challenge any residential ACM approval. If any interested party believes that a compliance program, an algorithm, or method of calculation used in a compliance program, a particular capability or other aspect of a program provides inaccurate results, the party may challenge the program. ~~(See Section Decertification of ACMs, for a description of the process for a challenge.)~~

1.6 Decertification of ACMs

The Commission may *decertify* (rescind approval of) an alternative calculation method through various means:

- All ACMs are decertified when the standards undergo substantial changes, which usually occurs every three years.
- Any ACM can be decertified by a letter from the ACM vendor requesting that a particular version (or versions) of the ACM be decertified. The decertification request ~~must~~shall briefly describe the nature of the program errors or "bugs" which justify the need for decertification.
- Any "initiating party" may commence a procedure to decertify an ACM according to the steps outlined below. The intent is to include a means whereby serious program errors, flawed numeric results, improper forms and/or incorrect program documentation not discovered in the certification process can be verified, and use of the particular ACM version discontinued. In this process, there is ample opportunity for the Commission, the ACM vendor and all interested parties to evaluate any alleged errors in the ACM program.

Process. Following is a description of the process for challenging an ACM or initiating a decertification procedure:

1. Any party may initiate a review of an ACM's approval by sending a written communication to the Commission's Executive Director. (The Commission may be the initiating party for this type of review by noticing the availability of the same information listed here.)
The initiating party shall:
 - (a) State the name of the ACM and the program version number(s) which contain the alleged errors;
 - (b) Identify concisely the nature of the alleged errors in the ACM which require review;
 - (c) Explain why the alleged errors are serious enough in their effect on analyzing buildings for compliance to justify a decertification procedure; and,
 - (d) Include appropriate data electronically (in a format agreed to by the Commission staff) on IBM PC compatible floppy diskettes and/or information sufficient to evaluate the alleged errors.
2. The Executive Director shall make a copy or copies of the initial written communication available to the ACM vendor and interested parties within 30 days.
3. Within 75 days of receipt of the written communication, the Executive Director may request any additional information needed to evaluate the alleged ACM errors from the party who initiated the decertification review process. If the additional information is incomplete, this procedure will be delayed until the initiating party submits complete information.
4. Within 75 days of receipt of the initial written communication, the Executive Director may convene a workshop to gather additional information from the initiating party, the ACM vendor and interested parties. All parties will have 15 days after the workshop to submit additional information regarding the alleged program errors.
5. Within 90 days after the Executive Director receives the application or within 30 days after receipt of complete additional information requested of the initiating party, whichever is later, the Executive Director shall either:
 - (a) Determine that the ACM need not be decertified; or,
 - (b) Submit to the Commission a written recommendation that the ACM be decertified.
6. The initial written communication, all other relevant written materials and the Executive Director's recommendation shall be placed on the consent calendar and considered at the next business meeting after submission of the recommendation. The matter may be removed from the consent calendar at the request of any person.
7. If the Commission approves the ACM decertification, it shall take effect 60 days later. During the first 30 days of the 60 day period, the Executive Director shall send out a Notice to Building Officials and Interested Parties announcing the decertification.

All initiating parties have the burden of proof to establish that the review of alleged ACM errors should be granted. The decertification process may be terminated at any time by mutual written consent of the initiating party and the Executive Director.

As a practical matter, the ACM vendor may use the 180- to 210-day period outlined here to update the ACM program, get it re-approved by the Commission, and release a revised version that does not contain the bugs initially brought to the attention of the Commission. Sometimes the ACM vendor may wish to be the initiating party to ensure that a faulty program version is taken off the market.

1.7 Alternative ACM Tests

This Manual provides tests to verify that ACMs are accurate. These tests are provided in Chapters 5 and 6 of the Manual. An ACM vendor may propose alternate tests when the vendor believes that one or more of the standard tests are not appropriate for the ACM. Alternate tests will be evaluated by the Commission and will be

accepted if they are considered reasonable. If accepted, the alternate test(s) will be added to this manual as an addendum and the alternate test(s) will be available for use by all ACMs. The alternate test will coexist with the standard test presented in this Manual until the Manual is revised. When a new version of this Manual is produced, the alternative test may be substituted for the current test or may continue to coexist with the original test.

1.8 Approval of New Exceptional Methods

The Commission may approve new exceptional methods. Exceptional methods are special modeling capabilities or calculation methods necessary to recognize building features that cannot be adequately modeled with existing ACMs. When an Exceptional Method is approved, a new optional capabilities test may be approved as part of the process. Exceptional Methods do not necessarily produce optional capabilities for ACMs. For instance, radiant heating systems are recognized by an adjusted equipment efficiency that may be used directly in ACMs or other compliance methods. To be approved for the new optional capability, vendors ~~must~~shall amend their ACM approval.

Even if an ACM already incorporates the Exceptional Method, the vendor ~~must~~shall receive approval to use the Exceptional Method in the compliance process. The ACM vendor ~~must~~shall demonstrate that the ACM automatically uses the correct fixed and restricted inputs for the Exceptional Method and that the standard reports identify the building feature(s) recognized by the Exceptional Method. Additionally, the ACM compliance supplement ~~must~~shall be updated, referencing the use of the new Exceptional Method.

To receive a copy of the Exceptional Method contact the Residential Office at (916) 654-4064.